ATTACHMENT 2
TEST PLAN

2.1 INTRODUCTION

The purpose of the Munitions Management Device, Version 1 (MMD-1) Test Plan is to: describe the test concept and process; describe the MMD-1 system and operation; identify test goals, objectives, and criteria; and identify proposed test data and data evaluation techniques.

Initial tests to verify MMD-1 equipment function will be conducted with simulated equipment test hardware (SETH), which will be filled with non-hazardous simulants. Following successful testing of the equipment recovered non-stockpile and reconfigured stockpile chemical warfare materiel (CWM) and Department of Transportation (DOT) cylinders containing chemical agents or the industrial chemical phosgene will be used to verify performance of the MMD-1 under controlled conditions.

2.2 GOALS

The system level goals of the MMD-1 test are:

- To demonstrate the capability of the MMD-1 system design to 1) load, breach, and manipulate various munition types and DOT cylinders identified in Table 2-6and 2) to chemically detoxify the agents of distilled mustard (HD), O-ethyl-S-(diisopropylaminoethyl methylphosphonothioate (VX), sarin (GB), and phosgene (CG) contained in these munition types and DOT cylinders.

- To collect process information (normal/other than normal) including temperature, pressures, flow rates, fluid levels, and heat rejection and to verify chemical detoxification of chemical agents using recovered munitions and commercially supplied industrial chemicals as indicated above.

- To demonstrate the ability of trained operators to safely operate and maintain the MMD-1 using the procedures and systems provided.

- To obtain data for system modifications (e.g., temperatures, pressures, flow rates, neutralization times, neutralization effectiveness, material handling, and operator interface), culminating in MMD-1 deployment.

2.3 CRITICAL TEST ISSUES

Critical test issues and data required to properly assess the MMD-1 have been defined and are presented in this section. Not all criteria may be quantified and not all criteria have rigid pass/fail standards. The MMD-1 test will address each critical test issue. The results will assess the overall performance of the system. Critical test issues to be addressed are:

- Is the MMD-1 equipment safe to operate and maintain?

- Can the MMD-1 System be safely operated and maintained by trained operational personnel while wearing appropriate PPE?

- Can the MMD-1 System load, breach, and manipulate both munitions and DOT-approved cylinders and access the chemical fill for detoxification?

- Can the MMD-1 System classify chemical agent or industrial chemicals to facilitate selection of appropriate treatment reagent?

- Can the MMD-1 System detoxify chemical agents and industrial chemicals to established performance treatment level goals?

- Can the MMD-1 System process wastes be properly characterized, safely contained, packaged, and managed?

- Can the MMD-1 System be operated in compliance with applicable Federal, State, and local regulations (i.e., environmental, safety, DOT, etc.)?

- Can the MMD-1 System be effectively decontaminated to the extent necessary to access the Munitions Treatment Vessel (MTV) to remove munition carcasses?

- Can the MMD-1 System be effectively decontaminated to render the system safe for closure, transport, and subsequent reuse?

To provide a standard for evaluation, selected operating parameters have been designated as requirements, goals, or indicators for assessing the successful performance of the mission by the MMD-1 test at DPG:

a. *Requirements.* Are defined as system parameters that are mandated by regulations or Army policy. Example sources of requirements include AR 385-61, the Army Toxic Chemical Agent Safety Program; MIL-STD 882C, System Safety Program; and the Resource Conservation and Recovery Act (RCRA) Research, Development, and Demonstration (RD&D) permit. The MMD-1 test will be judged successful only if the MMD-1 system has passed all requirements. An example of a requirements is the criterion that all safety and emergency response equipment and supplies are in place and ready for use.

b. *Goals.* Are system parameters that can readily be quantified and for which supporting documentation, statistics, or analyses exist, against which comparisons of MMD-1 test activities can be made. Both quantitative and qualitative assessments can be performed for activities for which goals have been developed. An example of a goal is the criterion that requires that each SETH, with fixture attached, be safely lifted from the floor of Building 3445, East Chamber, onto the MTV rail extension.

c. *Indicators.* Are defined as system parameters for which no published standards exist; however, they represent incidents that occur frequently enough during MMD–1 system testing to warrant documentation to describe MMD-1 performance. An example of an indicator is the criterion that requires that all MMD-1 systems are operational (placed in standby mode) during setup operations.

The following sections show each Critical Test Issue (CTI) and its associated evaluation criteria.

2.3.1 Critical Test Issue 1

Is the MMD-1 equipment safe to operate and maintain?

EVALUATION CRITERIA for CTI 1:

(**R**) No catastrophic failures occurred while the MMD-1 System was in normal operations.

(**G**) There was 100 percent adherence to current SOPs and O&M manuals for calibrating, monitoring and recording of all sensors - MINICAMS®, Viking, Depot Area Monitoring System (DAAMS), closed circuit television (CCTV), and Digital Control and Instrumentation System (DCIS), thermocouples, and transducers.

(**G**) All SETH items to be used during the MMD-1 test operations were used in accordance with appropriate SOPs.

(**G**) All maintenance operations associated with SETH operations were performed using provided tools, test measurement and diagnostic equipment, and repair parts.

(**G**) All maintenance operations were performed using provided tools, test measurement and diagnostic equipment, repair parts and personnel available.

(**I**) There were no reportable injuries, accidents or incidents.

(**I**) The MMD-1 equipment was capable of being disassembled in accordance with the current SOP 111 at Largo, Florida, transported to DPG, reassembled in accordance with current SOP 110, and checked out in accordance with current SOP 800.

2.3.2 Critical Test Issue 2

Can the MMD-1 system be safely operated and maintained by trained operational personnel while wearing appropriate PPE?

EVALUATION CRITERIA for CTI 2:

(**R**) There were no catastrophic failures while the MMD-1 System was in normal operations.

(**R**) MMD-1 system was operated and maintained according to issued RCRA RD&D permit.

(**R**) There was no personnel exposure to agents above the workplace vapor exposure limits (TWAs) presented in **Table 2-1**.

(**G**) The current set of SOPs and operations and maintenance (O&M) revisions provided for safe and effective MMD-1 operations and maintenance.

(**G**) SBC personnel, for their specific duties, could operate and maintain the MMD-1 system using the current SOPs and SBC procedures while wearing PPE appropriate to their required protection level without incurring any reportable injuries or accidents.

Table 2-1. Workplace Vapor Exposure Limits

Agent	Workplace TWA Levels (mg/m^3)[a]	ppmv[b]
Mustard (HG)	0.003	0.00045[c]
Sarin (GB)	0.0001	0.00002[c]
VX	0.00001	0.0000009[c]
Phosgene (CG)	0.4[d,e]	0.10[d,e]

NOTES:

a Milligrams per cubic meter
b Parts per million by volume at 25C and 760 Torr, except where otherwise noted
c Parts per million by volume at 20C and one atmosphere
d 29 Code of Federal Regulations (CFR) 1910.1000
e Ceiling value, not TWA; not to be exceeded at any time during the work day

(**G**) There was no release of agent vapors from the process trailer in excess of DPG established levels.
(**G**) SBC personnel were certified at the completion of the preoperational survey to accomplish all assigned primary and secondary duties in both operations and maintenance.
(**I**) No equipment downtime occurred as a result of improper preventive maintenance checks and services.
(**I**) No more than 20 percent of the tasks were rated as hard or difficult to accomplish in operating the MMD-1 System while wearing appropriate PPE.
(**I**) No more than 30 percent of the tasks were rated as moderately difficult to accomplish while operating the MMD-1 System and wearing appropriate PPE.
(**I**) At least 50 percent of the operating tasks were rated as easy to accomplish while wearing appropriate PPE.
(**I**) No more than 20 percent of the tasks were rated as hard or difficult to accomplish in maintaining the MMD-1 System while wearing appropriate PPE.
(**I**) No more than 30 percent of the tasks were rated as moderately difficult to accomplish while maintaining the MMD-1 System and wearing appropriate PPE.
(**I**) At least 50 percent of the maintenance tasks were rated as easy to accomplish while wearing appropriate PPE.

2.3.3 Critical Test Issue 3

Can the MMD-1 system load, breach, and manipulate both munitions and DOT approved cylinders and access the chemical fill for detoxication?

EVALUATION CRITERIA for CTI 3 (SETH and CWM):
(**R**) All SETH, CWM munitions and DOT cylinders were loaded.
(**R**) All SETH, CWM munitions and DOT cylinders were breached.
(**R**) All SETH, CWM munitions and DOT cylinders were accessed for the chemical fill.

(**R**) All SETH, CWM munitions and DOT cylinders were manipulated within applicable tolerances to the extent necessary to position the item, access the fill, remove the coupon and drain the chemical fill.
(**R**) No release of agent or waste occurred outside Building 3445 engineering controls.
(**R**) There was no personnel exposure to agents above the workplace vapor exposure limits. See **Table 2-1**.
(**G**) There was 100 percent adherence to current operating and maintenance SOPs and SBC procedures applicable to operating and maintaining the MMD-1 from start-up through the completion of the loading, breaching, accessing, and manipulation for monitoring and recording of all sensors.
(**G**) There was no release of vapor agents from the process trailer in excess of DPG established levels.
(**G**) There was no release of vapor agents from the Unpack Area in excess of DPG established levels.
(**G**) Chain-of-custody documents were prepared in accordance with QA/QC plans 100 percent of the time.
(**I**) There were no false alarms of the MMD-1 sensors hardware or software.

2.3.4 Critical Test Issue 4

Can the MMD-1 System classify chemical agent or industrial chemicals to facilitate selection of appropriate treatment reagent?

EVALUATION CRITERIA for CTI 4:

(**R**) There was no personnel exposure to agents above the workplace vapor exposure limits. See **Table 2-1**.
(**G**) There was 100 percent accuracy by the MMD-1 system in classifying agent/industrial chemicals.
(**G**) SBC personnel, for their specific duties, could operate and maintain the MMD-1 system using the current SOPs and SBC procedures.
(**G**) All maintenance operations were performed using provided tools, test measurement and diagnostic equipment, repair parts, and personnel available.
(**I**) There were no false alarms of monitoring equipment.
(**I**) There were no gas chromatograph/mass spectrometer (GC/MS) Viking failures during processing.
(**I**) There were no sampling/monitoring equipment failures during processing.

2.3.5 Critical Test Issue 5

Can the MMD-1 System detoxify chemical agents and industrial chemicals to established performance treatment level goals?

EVALUATION CRITERIA for CTI 5:

(**R**) All CWM items were detoxified to established treatment levels.
(**R**) There was no personnel exposure to agents above the workplace vapor exposure limits. See **Table 2-1**.
(**G**) The chain of custody for lab samples was followed according to the QA/QC plan.
(**G**) The correct volume and mixture of reagent was used 100 percent of the time in accordance with SBC procedures.
(**G**) 100 percent of all DCIS measured and recorded pressures, temperatures, flow rates and quantities remained in the nominal band of values.

(**G**) Correct inputs to DCIS were used per appropriate SOP occurred 100 percent of the time.
(**G**) Sampling conducted in accordance with SOP 100 percent of the time.
(**G**) All lab instruments were correctly calibrated 100 percent of the time.
(**G**) 100 percent of all required operations and maintenance activities were successfully completed by SBC personnel while wearing appropriate PPE.

2.3.6 Critical Test Issue 6

Can the MMD-1 System process wastes be properly characterized, safely contained, packaged, and managed?

EVALUATION CRITERIA for CTI 6:

(**R**) There was no release of agent or waste outside Building 3445 engineering controls.
(**R**) The Waste Analysis Plan was followed to characterize waste streams.
(**R**) Wastes were properly characterized and land disposal restriction requirements identified for shipment offsite to a permitted TSDF.
(**R**) No personnel exposures to agents above the workplace vapor exposure limits. See **Table 2-1**.
(**G**) SBC personnel, for their specific duties, could sample process wastes using the current SOPs and SBC procedures while wearing PPE appropriate to their required protection level without incurring any reportable injuries or accidents.
(**G**) There was no release of agent vapors from the process trailer in excess of DPG established levels during CWM processing.

2.3.7 Critical Test Issue 7

Can the MMD-1 System be operated in compliance with applicable Federal, State, and local regulations (i.e., environmental, safety, DOT, etc.)?

EVALUATION CRITERIA for CTI 7:

(**R**) The MMD-1 system was operated in compliance with all applicable Federal, State, local laws, and regulations.
(**R**) 100 percent compliance was accomplished with chain of custody and destruction certificate requirements and all were accounted for.
(**G**) Destruction certificates were accurately kept for all CWM.
(**I**) There were no reportable injuries, accidents or incidents.

2.3.8 Critical Test Issue 8

Can the MMD-1 system be effectively decontaminated to the extent necessary to access MTV to remove munition carcasses?

EVALUATION CRITERIA for CTI 8:

(**R**) There was no release of agent or waste outside Building 3445 engineering controls.
(**R**) There was no personnel exposure to agents above the workplace vapor exposure limits. See **Table 2-1**.
(**G**) There was no release of agent vapors from the process trailer in excess of DPG established levels.
(**G**) SBC operators wearing appropriate level of PPE were able to safely retrieve the CWM carcass from the process trailer and place it in temporary solid waste storage.

2.3.9 Critical Test Issue 9

Can the MMD-1 system be effectively decontaminated for closure, transport, offsite and subsequent reuse?

(**R**) Approved closure plan was followed.
(**R**) The MMD-1 system was at or below acceptable U.S. Army decontamination levels prior to disassembly.
(**R**) RCRA closure was certified by independent registered professional engineer.
(**R**) There was no personnel exposure to agents above the workplace vapor exposure limits. See **Table 2-1**.
(**G**) Using SOPs, the requirement for decontamination levels necessary for transport were met.
(**G**) There was no release of chemical agents or wastes from the process trailer or UPA outside engineering controls.

2.4 SCOPE OF TEST

The MMD-1 test will involve the evaluation of the following activities:

- Prerequisites to test
- CWM treatment operations
- MMD-1 closure and closeout operations
- Support activities during test.

The sequence of events and actions are shown in **Figure 2-1**. The following paragraphs describe the activities to be evaluated.

2.4.1 Prerequisites to Test

Prerequisites to the test are transport, receipt, and inspection of the MMD-1 system, system placement and assembly, system integration and support system checkout, operator training, and the evaluation of the MMD-1 system using SETH. Prerequisite test activities will be qualitatively evaluated and will not have pass/fail standards. The SBC will collect data such as: time required to conduct activities, effectiveness of SOPs, transport requirements, material handling requirements, personnel required, and equipment inventory. After SETH operations are completed, one or more Operational Readiness Evaluations (ORE) and a preoperation survey will be conducted to verify that the MMD-1 system is ready for test operations using CWM items.

2.4.1.1 Transportation of the MMD-1 to the Test Site

The MMD-1 will be transported from the General Fabrication Contractor (GFC) facility to DPG by road. Qualitative data, including observations, interviews, and inspections, will be collected to document how the move is accomplished, how well the equipment endures the move from vibrational stress, and whether any further special preparations will be required to prepare the MMD-1 for subsequent transport.

2.4.1.2 Receipt and Inspection of Equipment

The MMD-1 and all ancillary and support equipment, will be received, unpacked, inventoried, and inspected for completeness and damage. Repairs, adjustment, and calibrations will be accomplished as

required, and before operational checks. Adjustments, repairs, and calibrations of Building 3445 equipment will also be performed.

2.4.1.3 System Placement and Assembly

Setup of the MMD-1 will involve transforming the MMD-1 from "transportable configuration" to "operating configuration." Detailed information will be collected during this process to provide a basis for making recommendations for future improvements in procedures or hardware design. Successful preparation for operation will be the criterion for this activity.

Setup of the UPA will involve the delivery, positioning, and hookup of UPA monitoring, CCTV, and ventilation systems inside Building 3445, East Chamber. The SBC personnel will install the UPA support equipment, prepare it for operational readiness, and confirm that the UPA has been properly setup by performing post-setup checks. Successful preparation for operation will be the criterion for this activity.

Initial placement of the hardware in and around Building 3445 shall be in accordance with site layout drawings and SOPs

2.4.1.4 Systems Integration and Support System Checkout

Systems integration begins once all skids and trailers are in place. In particular, methods and time required for integration will be noted. Problems encountered during system integration due to placement of hardware will be noted for reference in laying out future sites. Deficiencies observed in the SOPs during System Integration will be noted and corrected using a pre-established approval cycle.

Though the test objectives specific to System Integration are aimed at verifying the system is interfaced correctly, data regarding time and methods to complete integration will be recorded. At a minimum, the following data will be collected:

- Date of all operations
- Temperature
- Location of skids
- Location of trailers
- Methods for moving skids and trailers
- Special requirements for moving hardware
- Time required for placement and system integration
- Number of personnel required
- Special equipment required
- Data collected on electrical cables
- Data collected on hoses and piping.

The system integration and support system checkout follows a specific sequence of testing as noted in the Program and Integration Support Contractor (PAISC)-developed Component and Systemization Test Plan used during acceptance testing. Each subsystem will be verified in accordance with their specific operating parameters and then the system will be verified ready for beginning SETH operations.

Data collected during this activity will include: effectiveness of SOPs, times required for subsystem and system checks, Munitions Handling Equipment (MHE) required, personnel required, pressures, flow rates, interviews of personnel, utility hookups, plumbing lengths, and general Building 3445 accommodations.

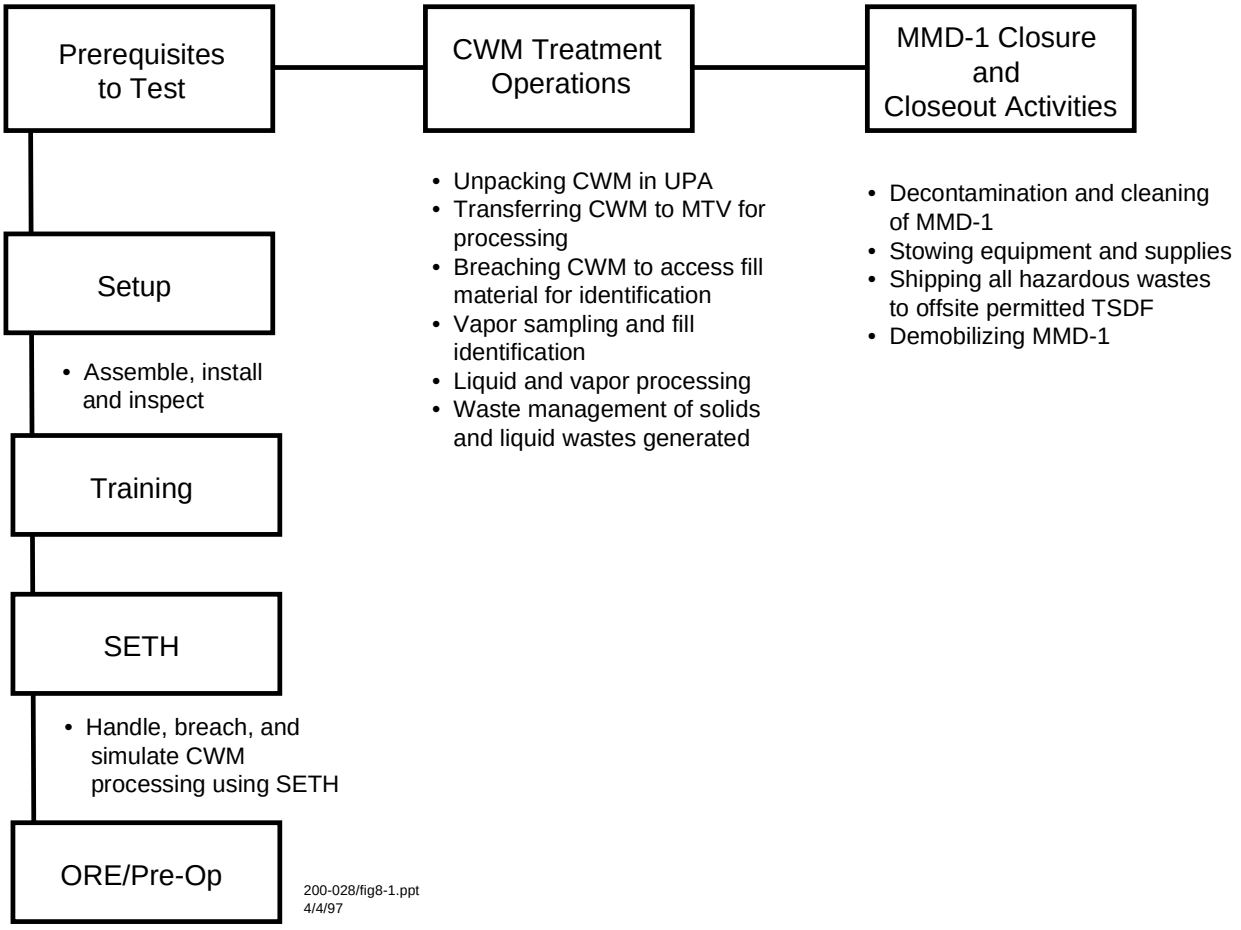

Figure 2-1 MMD-1 Test Elements

2.4.1.5 Operator Training

Training of SBC personnel will be primarily conducted by the SBC in accordance with their MMD-1 Training Plan. Government-furnished equipment (GFE) training will be provided to the SBC specifically for the MINICAMS®, Viking GC/MS, DPG Site Specific, and the Tate Systems developed the DCIS.

The PMNSCM will verify that the SBC is prepared to operate and maintain the MMD-1 system. Training will be evaluated during the OREs and Pre-Op conducted by the PMCD. The survey will be performed in accordance with Army procedures.

All members of the SBC MMD-1 test team will be trained in accordance with the SBC MMD-1 Training Plan documented in Section 12 of this permit application.

2.4.1.6 Simulated Equipment Test Hardware Operations

During SETH operation, the capability of the MMD-1 to handle breach and process CWM munitions or DOT containers will be examined using SETH. SETH will simulate the CWM item configurations that may be found at burial sites and that will be processed during the test. Large SETH (M78 500-pound

bombs), thick-skinned SETH projectiles (8-inch and 155-mm artillery projectiles, and 4.2-inch mortars), and small SETH (M139 bomblets) will be used as test items to evaluate the munition handling capability. DOT cylinders will also be used. The SETH will be filled with innocuous (inert, harmless) simulants. Both water and methyl salicylate (MES), also known as wintergreen oil, will be used in SETH munitions to simulate the liquid chemical agents. However, only one round will contain MES.

The MMD-1 will breach and perform simulated detoxification of the SETH listed in **Table 2-2**. The following munition types are considered to be represented by the munition types listed in **Table 2-2** and therefore will not be processed during SETH operations: 105 mm, stokes, 175 mm, livens drum, and M70 bomb. A CWM dress rehearsal will be conducted as a last check to ensure that both the MMD-1 System and the SBC are ready to begin CWM operations. As such, the SBC will process eight SETH items as if the items contained agent. The operations will be conducted in the actual order as would occur during CWM operations and personnel will be in full PPE. Vapor and liquid samples will be taken and analyzed in accordance with the appropriate SOPs. During dress rehearsal, actual reagents will be used; however, no simulant other than water will be used for the munition fill. **Table 2-3** presents the proposed CWM dress rehearsal test matrix.

During SETH activity, the SBC will collect data such as: time required to conduct activities, effectiveness of SOPs and test procedures, equipment operating parameters, pressures, temperatures, flow rates, air monitoring, UPA activities to include ability to use MTV fixtures, and related UPA equipment.

Table 2-2. SETH List

Equivalent Munition Item	Proposed Quantity	Diameter (in.)	Material Construction	MMD-1 Fixture & Clamp Kit	Fill
M125	6	3.63	Sheet Steel	S43030-10 S43033-10	MES, Water, or Air
M139	6	4.5	6061-T6 Aluminum	S43030-10 S43033-10	MES, Water, or Air
75 mm	7	2.95	Steel	S43040-10 S43042-10	MES, Water, or Air
4.2-in. mortar	8	4.19	Steel	S43030-10 S43033-10	MES, Water, or Air
155 mm	7	6.08	Steel	S43020-10 S43023-10	MES, Water, or Air
8-in. Projectile	10	7.98	Steel	S43020-10 S43025-10	MES Water, or Air
M47 Bomb	7	8.1	Sheet Steel	S43020-10 S43025-10	MES, Water, or Air
M78 Bomb	8	14.18	Forged Steel	S43010-10 S43013-10	MES, Water, or Air
DOT Cylinder	5		Stainless Steel		MES, Water, or Air
DOT Cylinder	7		Carbon Steel		MES, Water, or Air

MES = methyl salicylate

a SETH items will be provided from available stocks from Ammunition Equipment Directorate or other designated source by Program Manager for Non-Stockpile Chemical Materiel.

Table 2-3. Proposed CWM Dress Rehearsal Test Matrix

Container or Munition	Condition of Container - Number of Items	Neutralization Treatment Procedure	Fill
Bomb, M78	Pristine - 1	731 CG	Water
Bomblet, Half, M139	Pristine - 1	720 GB	Water
Bomblet, M125A1	Pristine - 1	720 GB	Water
Projectile, 8-in.	Plaster Patch - 1	720 GB	Water
Overpack, 8-in.	Pristine - 1	720 GB	Water
DOT Cylinder	Pristine - 1	750 VX	Water
Projectile, 155 mm	Pristine - 1	710 HD	Water
Mortar, 4.2-in.	Pristine - 1	710 HD	Water

2.4.2 CWM Treatment Operations

MMD-1 test operations will involve the handling, accessing, and detoxifying of chemical agents mustard (HD), sarin (GB), and O-ethyl-S-(diisopropylaminoethyl) methylphosphonothioate (VX), and industrial chemical phosgene (CG) containers.

2.4.2.1 CWM Item Transfers and Unpack Area Operations

a. *Munition Transfers.* Truck transport of CWM munitions or DOT cylinders from the DPG Igloo G will not be qualitatively evaluated because such onsite movements are routine. The munitions or DOT cylinders will be transported by DPG personnel from Igloo G to the Munition Service Magazine (MSM) at Building 3445 according to DPG procedures. Upon arrival, the SBC will receive the items, complete the proper chain of custody forms, and transfer the munitions or DOT cylinders into the MSM where they will be stored until processing operations begin. Upon start of operations involving chemical agent/industrial chemical (hot operations), the SBC will perform first entry monitoring of the MSM and upon safe confirmation will move the munition or DOT cylinder from the MSM to Building 3445, East Chamber, in accordance with SOPs.

b. *Container/Overpack Handling.* Container/overpack handling of CWM munitions or DOT containers will be qualitatively evaluated. The SBC operators will load the CWM by handcart into the UPA. If a munition, the SBC MMD-1 operators will open the overpack, determine (through observation and vapor sampling via a MINICAMS®) if the CWM item is leaking, remove the CWM item from the container/overpack, repair the item if necessary using plaster of paris and tape, place the CWM item in a temporary overpack, and dispose of the used container, overpack, and packing materials. The SBC operators will place the CWM or DOT container on an MMD-1 test fixture and transport it by handcart to the MTV.

c. *Sampling.* Vapor samples from CWM or DOT containers will be qualitatively evaluated. A MINICAMS® will be used to aid in determining if the CWM item is leaking. Liquid and solid sampling will not be conducted in the UPA to characterize CWM item contents. If leaking, the vapor sample taken by the MINICAMS® (gross-level) will help identify

the CWM item contents. If not leaking, the contents will have already been identified from the Munitions Assessment Review Board (MARB) process and will be confirmed by the Viking® GC/MS, DAAMS, MINICAMS®, or sample bombs, while the CWM is inside the MTV prior to adding treatment reagent.

d. *CWM Handling.* The SBC operators will move the CWM or DOT containers from the UPA to the rear of the process trailer, lift/move the items into the MTV, and secure the CWM or DOT container for processing via the handling and loading system.

2.4.2.2 CWM Item Handling, Breaching, Treatment

a. *CWM Munition or DOT Container Handling.* During this operation, the capability of the MMD-1 to handle CWM munitions or DOT containers will be examined using recovered CWM munitions or DOT containers and gas cylinders of phosgene.

b. *CWM Munition or DOT Container Access.* The MMD-1 will breach CWM munitions or DOT containers by using end mill or hole saw in the MTV.

c. *Verification of Chemical Agent or Industrial Chemical.* CWM munitions or DOT containers to be detoxified in the MTV will contain either chemical agents HD, GB, or VX, or the industrial chemical phosgene. Prior to adding treatment reagent to the chemical agent or industrial chemical, a vapor sample will be collected and analyzed using a Viking® GC/MS, DAAMS, MINICAMS®, or sample bomb. Analysis will occur in approximately 20 minutes. Once the chemical agent or industrial chemical has been verified, the operators will use the appropriate reagent. The CWM item will not be treated unless the contents are known. Information from the MARB, Viking® GC/MS, DAAMS, MINICAMS®, or sample bomb samples will be considered.

d. *Liquid Chemical Agent Processing.* The chemical agents and industrial chemicals will be processed separately by campaigns. Munitions and DOT cylinders from a chemical agent or industrial chemical type campaign will be completed before processing a different chemical agent. The order in which the chemical agents and industrial chemicals will be processed has been tentatively determined: CG, GB, VX, and HD. This order was determined based on the desire to first detoxify the chemical agents and industrial chemicals that could be done most efficiently. Phosgene is considered to be easier to detoxify and more easily rinsed from the MMD-1 equipment. HD and VX are anticipated to be more difficult to remove from the MMD-1 equipment.

e. *Gas Chemical Agent Processing.* At the present time, only a limited amount of gaseous chemical agent-filled CWM munitions or DOT containers is available in the DPG inventory. To provide additional gas for MMD-1 treatment testing, phosgene packaged in standard DOT gas cylinders will be acquired commercially.

f. *Reagent Transfer.* The reagents shown in **Table 2-4** will be used to treat chemical agent or industrial chemicals during test operations. Reagent will arrive onsite pre-mixed by the vendor.

g. Upon completion of the detoxification process, the liquid waste will be transferred to either or both of the two surge tanks located on a skid adjacent to the process trailer, inside the East Chamber of Building 3445. Prior to transferring the waste to bulk waste DOT-approved containers located in the Building 3445 West Chamber, samples will be

collected and analyzed by the SBC mobile chemical laboratory to confirm that the chemical agents have been treated to less than 50 mg/L and to determine if the treatment performance goal of 1 mg/L has been met. Following confirmation of the treatment level (50 mg/L), a sample will be collected for RCRA waste characterization. The waste will then be transferred via flexible hose from the surge tanks through the East - West Chamber dividing wall, into the West Chamber, and then into the DOT-approved bulk containers. The waste-transfer pump located on the surge tank skid will be used for this transfer.

Table 2-4. Reagent List for CWM Operations

Chemical Agent or Industrial Chemical	Reagent
GB	Monoethanolamine and water (MEA and water)
Phosgene	Sodium hydroxide (NaOH) and water
HD	Monoethanolamine (MEA) and water
VX	Monoethanolamine (MEA)/sodium hydroxide (NaOH)

NOTE: Phosgene will be obtained and will represent CG.

2.4.2.3 Waste Management

Wastes generated from the MMD-1 process operation and from closure activities will be characterized as described in the Waste Analysis Plan provided in Section 4, and managed as described in Section 5 of this permit application. Evaluations will be conducted on adherence to and applicability of characterization activities and waste management practices.

2.4.3 MMD-1 Closure and Closeout Operations

Closure and closeout activities will involve the removal of final MMD-1 process wastes from Building 3445, decontaminating and cleaning the MMD-1 according to the approved closure plan, stowing all equipment and supplies, shipping all hazardous wastes offsite to a permitted hazardous waste treatment, storage, and disposal facility (TSDF), and demobilizing the MMD-1 for future reuse. The closure plan to be followed is presented in Section 11 of this permit application.
Data collected for assessing the MMD-1 closure and closeout activities will consist primarily of comments and recommendations for future improvements.

2.5 SAFETY AND HEALTH

Data will be collected throughout the conduct of the test to examine the overall safety and health implications of operating the MMD-1 system. Applicable regulatory and statutory guidelines will be used to conduct the safety evaluation.

2.6 MAINTENANCE OPERATIONS

Maintenance requirements will be assessed during setup, SETH operations, and CWM munition or DOT container operations processing. The SBC will maintain the MMD-1 using the O&M Manuals. Corrective maintenance, necessitated by actual component failures during the test, will be observed and

evaluated, as well as routine or "preventive" maintenance. Maintenance operations will be qualitatively evaluated and will not have a pass/fail criterion.

Test results will identify areas for improvement. Maintenance required on MMD-1 components to allow the test to proceed will be reviewed after each occurrence. Evaluation will be qualitative because of the limited numbers of trials and length of operation. Observations, suggestions, and comments as to the adequacy of the procedures defined for the maintenance requirement will be recorded during the training and the actual test. Appropriate changes to the procedures will be accommodated during the test.

2.7 TEST LOCATION

The MMD-1 test will be conducted in Building 3445, East and West Chambers, Carr Facility, at DPG. A complete description of the test location is provided in Section 2 of this permit application. Information about Building 3445 is in Section 5.

2.8 TEST ORGANIZATION

The organizations participating in the MMD-1 test are shown in **Figure 2-2**. Participating organizations will provide the support described below:

a. PMCD:

(1) Provides overall direction and funding for the MMD-1 program and provide the MMD-1 test leader.

(2) Provides functional support in the areas of safety, quality assurance, environmental compliance, monitoring, and analysis.

(3) Approves the site-specific monitoring plan and other support plans.

(4) Conducts the preoperational survey.

(5) Establishes a Hazard Analysis Working Group (HAWG) for the MMD-1 test consisting of representatives from PMCD, DPG, and the SBC.

b. SBC:

(1) Tests, operates, and maintains the MMD-1.

(2) Provides and operates a mobile chemical laboratory during the MMD-1 testing for the analysis of chemical agent and industrial chemical.

(3) Compiles operational data and records of maintenance of the MMD-1 at DPG. Will provide those records to the MMD-1 evaluation contractor for extraction of relevant test data.

(4) Ensures that crews have been trained and are qualified for conducting operations with hazardous waste, including attendance at OSHA 29 Code of Federal Regulations (CFR) 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER) training.

(5) Provides for transportation, final treatment, and disposal of MMD-1 wastes.

(6) Develops the MMD-1 Site-Specific Work Plan.

(7) Develops the Safety Health and Emergency Response Plan.

c. U.S. Army DPG West Desert Test Center Materiel:

(1) Provides the Test Director for the MMD-1 test.

(2) Provides a test officer to plan and coordinate support to the MMD-1 system test. The test officer will coordinate the activities of other DPG organizations, such as the Security Office and the Compliance Office, during the test.

(3) Prepares supporting plans and SOPs for support provided to MMD-1 operations.

(4) Provides personnel to operate Building 3445.

(5) Provides munition-handling support, as required, to transport CWM munitions or DOT cylinders from Igloo G to the MSM located at the Building 3445 facility area.

(6) Provides change-house services for all test personnel, and personal protective equipment normally available at DPG for test personnel other than SBC employees.

(7) Provides security for the MMD-1 while it is operating at Building 3445.

(8) Arranges for emergency support services, including medical and fire fighting, during MMD-1 operations if needed.

(9) Provides, in addition to the fixed monitoring locations per the Air Monitoring Plan at Building 3445 (DPG, Utah), a monitor at the exhaust of the East Chamber ventilation system. Records and provides monitoring results to the SBC for all specified locations.

d. U.S. Army DPG Compliance Office:

(1) Provides DPG safety oversight during the MMD-1 system test.

(2) Prepares the site plan and safety submission for MMD-1 operations at DPG. Coordinates staffing.

e. U.S. Army DPG Environmental Office:

(1) Provides DPG environmental compliance oversight during the MMD-1 system test.

(2) Communicates with the State of Utah Department of Environmental Quality and the Environmental Protection Agency.

f. DPG Combined Chemical Test Facility:

Will provide chemical analysis backup support, as required, for independent verification of results from the SBC laboratory testing of air, vapor, liquid, and solid samples.

g. U.S. Army Edgewood Chemical Biological Center.

Will provide research and technical support services for chemistry matters associated with MMD-1 design and environmental permit applications. Will document appropriate test chemistry work completed for the MMD-1.

h. PAISC:

(1) Develops documentation required to support MMD-1 operations at West Desert Test Center, including operation and maintenance procedures for operating and maintaining the MMD-1 at West Desert Test Center.

(2) Provides other technical support as directed by PMCD.

i. System Evaluator:

(1) Prepares an independent evaluation/test design plan, prior to the test.

(2) Chairs the DAG

(3) Observes and collects data with which to evaluate the system during the test.

(4) Prepares an independent evaluation report with respect to system operations.

j. Safety and Environmental Evaluator

(1) Prepares an independent evaluation plan before the test
(2) Observes and collects data to evaluate the system during the test
(3) Prepares an independent evaluation report with respect to safety and environmental compliance

k. The MMD-1 Hazard Assessment Working Group (HAWG):

(1) The HAWG will be an advisory panel consisting of senior officials and experienced technicians, and will provide short-term guidance to the MMD-1 project manager for addressing non-routine events. The recommendations are intended to be short term in nature and addressed to returning the MMD-1 system to a safe operating mode. If longer-term permanent changes are identified, these will be referred to the system control board for further consideration and approval. The MMD-1 HAWG will consist of representatives from PMCD, DPG, SBC, and PAIS.

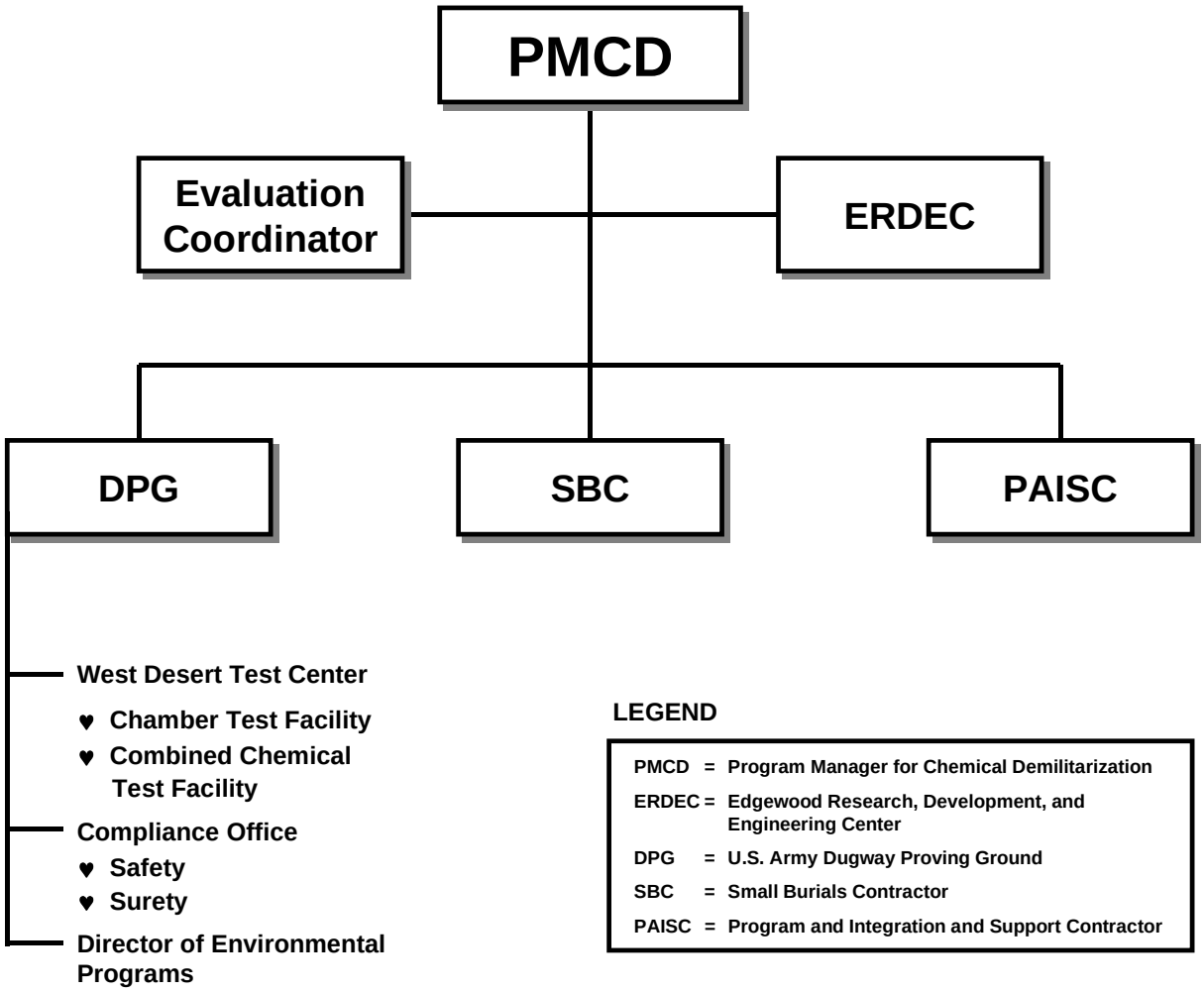

Figure 2-2. MMD-1 Test Organization

2.9 PERSONNEL QUALIFICATIONS

The MMD-1 test will be conducted by the SBC and personnel from DPG. The participants will include test supervisors, operators, technicians, administrative assistants, and safety and security personnel. The specific positions and qualifications of the participating personnel are discussed in Section 12 of this permit application.

2.10 TEST SCHEDULE

The test is scheduled to start in the summer of 1999. It is anticipated that the duration of the test will be 27 weeks.

2.11 MUNITION FEED RATES

Although one to four CWM items (munition or DOT cylinder) will be processed per day during testing of the MMD-1, only one CWM item at a time will be handled in the UPA or will be processed in the MMD-1. Treatment will occur by chemical agent or industrial chemical campaign. Only one type of chemical agent or industrial chemical will be treated at a time.

2.12 OPERATING PARAMETERS AND EXPERIMENTAL RANGES

The list of MMD-1 operating parameters and associated experimental ranges is presented in **Table 2-5.**

2.13 JUSTIFICATIONS FOR QUANTITIES AND OPERATING TIME

Table 2-6details the quantities of chemical agent and industrial chemical and associated munition or DOT container to be used during testing. The quantity of chemical agents and industrial chemicals presented, as well as the munition type and DOT containers selected for this test, were based on the U.S. Army's current inventory of CWM containing chemical agents, the availability of phosgene at DPG or by commercial vendor, the maximum chemical agent and industrial chemical quantities that can be batch processed in the MMD-1 system, the minimum quantities of chemical agents and industrial chemicals considered appropriate to demonstrate the ability of the MMD-1 system to perform detoxification reactions, and the proposed duration for performing the MMD-1 test.

Table 2-5. Operating Parameters and Experimental Ranges

Operating Parameter	Experimental Range
CWM item size and construction	Bomblets, projectiles, mortars, DOT containers, stainless steel, carbon steel, various alloys.
CWM fill	HD, GB, VX, CG
CWM fill quantities:	
HD	0.32 L to 22.6 L
GB	0.54 L to 3.65 L
VX	2.24 L to 22.6 L
CG	2.61 L to 22.6 L
Treatment Reagent for:	
HD	MEA and Water (90%/10% by volume)
GB	MEA and Water (45%/55% by volume)
VX	NaOH and MEA and Water (50% NaOH by weight)
CG	NaOH and Water (20%/80% by volume)
Treatment Performance Goal Level	1 mg/L
CWM Iterm Feed Rate	1 to 4 items per day
Reagent Temperature	68 to 140 F
Minimum Treatment Ratio (Reagent to Agent):	
HD	10:1 volumetric
GB	10:1 volumetric
VX	10:1 volumetric
CG	10:1 volumetric
Agent Injection Pump (CG treatment)	1 to 3 gpm
MTV rinsing (water) per CWM item, with spray nozzles	30 to 180 seconds
Liquid Treatment:	

Table 2-5. Operating Parameters and Experimental Ranges

Operating Parameter	Experimental Range
HD	30 to 240 minutes
GB	15 to 60 minutes
VX	15 to 240 minutes
CG	10 to 30 minutes
Recirculation of rinsewaters in liquid processing system	15 to 60 minutes
Gas treatment	0 to 60 minutes
Process vapor samples of waste gas knockout drum to monitor treatment progress[a]	0 to 1 per munition
HPWP spray of munition	30 to 180 seconds
LRV liquid level	0 to 44 inches
MTV liquid level	0 to 23 inches

NOTES:

a Treatment progress may be monitored based on vapor concentrations, liquid concentrations, or residence time for liquid treatment; therefore vapor samples may not be required.

ASTM = American Society of Testing and Materials
DOT = Department of Transportation
L = liter

Table 2-6. Chemical Agent and General Industrial Chemical Amount and General Chemical Warfare Test Items or DOT Containers *

Agent	Total Agent	Total Items	General Munition Types
H, HD	300 pounds	17	4.2 inch mortar or equivalent cylinder M47 or equivalent cylinder Other cylinders simulating munition types
GB	150 pounds	47	4.2-inch mortar or equivalent cylinder Stokes mortar or equivalent cylinder Other cylinders simulating munition types M139and equivalent cylinder 155 mm or equivalent cylinder
VX	225 pounds	28	155 mm or equivalent cylinder 8 inch projectile or equivalent cylinder Other cylinders simulating munition types
CG	1,000 pounds	15	155 mm projectile or equivalent DOT cylinder M78 or equivalent DOT cylinder DOT cylinders (various sizes)

* a more complete list is presented in Attachment 3

2.14 CRITERIA FOR DETERMINING SUCCESS/FAILURE

The MMD-1 test will demonstrate and verify the capability of the MMD-1 to destroy typical CWM recovered from small burial sites or ranges. Data will be collected for each test activity shown in **Figure 2-1**, and will be documented in the following format.

Objective:	A test objective describes or lists the purpose or goal of an individual test activity.
Criteria:	Test criteria describe the standards by which test activity performance is measured. For the MMD-1 test plan, test criteria for each test activity have been identified as requirements, goals, or indicators. A more detailed discussion about these criteria types is presented below.
Test Method:	A test method describes the procedures used to collect test data. Test methods involve techniques that observe and record test activities.
Data Required:	The data required discussion describes or lists the test data to be collected. The data collected can be used to assess each test element and the full series of critical issues for the MMD-1 system.
Data Analysis:	The data analysis discussion describes the aspects of the test activity that are to be assessed and evaluated.

2.15 PERSONNEL TRAINING [40 CFR 264.16; R315-8-2.7]

The MMD-1 training program will provide MMD-1 employees with the necessary knowledge and skills to perform hazardous waste duties safely and efficiently, and to ensure that hazardous activities are conducted in an environmentally sound manner. The training program will provide MMD-1 employees with an understanding of the MMD-1 system operations, especially the safety and emergency response operations. The MMD-1 Training Program is described in Section 12 of this permit application.

2.16 DATA REPORTING/RECORDKEEPING

The SBC will collect, control, and manage all data generated during testing of the MMD-1 at DPG, Utah. During the test operations, a Daily Report will be generated detailing each day's activities and will contain information collected in each functional area (i.e., laboratory, environmental, safety, air monitoring, maintenance, etc.). Upon completion of the test and closure of the MMD-1, data will be reduced, evaluated, and final conclusions drawn on the success or failure of the MMD-1 system and operations. This information will be compiled and provided in a final test document.